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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 158466 HT-BF	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/NO2004/000195	International filing date *(day/month/year)* 28.06.2004	Priority date *(day/month/year)* 04.07.2003
International Patent Classification (IPC) or national classification and IPC H04J14/06		
Applicant TELENOR ASA et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 21 sheets, as follows:
      - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I	Basis of the opinion
☐ Box No. II	Priority
☐ Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV	Lack of unity of invention
☒ Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI	Certain documents cited
☐ Box No. VII	Certain defects in the international application
☐ Box No. VIII	Certain observations on the international application

Date of submission of the demand 28.01.2005	Date of completion of this report 19.08.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Chauvet, C Telephone No. +49 89 2399-7090

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

4, 8, 11-15, 18, 20-27	as originally filed
6, 16	received on 28.01.2005 with letter of 25.01.2005
1-3, 5, 7, 10, 17, 19	filed with telefax on 22.06.2005
9	received on 28.07.2005 with letter of 14.07.2005

Claims, Numbers

1-31	received on 28.07.2005 with letter of 14.07.2005

Drawings, Sheets

2/11-7/11, 10/11, 11/11	as originally filed
1/11, 8/11, 9/11	filed with telefax on 22.06.2005

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-31
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-31
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-31
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

1. Technical field

The subject-matter defined by independent claims 1 and 18 relates to the transmission of optical packets.

2. Novelty and inventive step

None of the prior art documents cited in the International Search Report discloses or suggests the use of the state of polarisation in order to differentiate Qualities of Service (QoS).

Having different states of polarisation for packets of different QoS presents the advantage of offering an alternative way of providing a plurality of QoS in an optical packet network.

The subject-matter of claims 1 and 18 is therefore considered to be new (Article 33(2) PCT) and involving an inventive step (Article 33(3) PCT).

3. Dependent claims

Remaining claims 2-17 and 19-31 being respectively dependent on claims 1 or 18, their subject-matter is also considered to be new and involving an inventive step (Article 33(2) and (3) PCT).

Figure 10 shows, a network with a number of nodes and QoS connections between some of these,

Figure 11 shows a reference scenario for a pan-European network with 37 nodes, with a maximum node degree of 5.

Detailed description of the invention

In the following it is given a detailed description of the present invention with support in the enclosed figures. As mentioned earlier there are several problems related to OPS. The present invention is addressing these problems by the use of polarization for signalling.

One can imagine the signalization being used in different ways:

3a) Synchronizing, the state of polarization changes at the beginning of each packet.

3b) Header- and payload within each packet is separated by orthogonal states of polarization.

3c) QoS-classes are separated by assigning different priority to packets to be processed, thus having different polarization on the transmitter side.

In figure 1 it is given an example on how the states of polarization may be used for optical separation between two different QoS-classes. The same principle may be utilized to separate optically between a header- and a payload. The method may, with the use of a polarization beam splitter, separate the information independent of the wavelength. If a WDM-signal with a number of wavelengths is sent towards the splitter, the splitter will function as a demultiplexer for header- and payload or QoS-classes for all the wavelengths.

USE OF POLARIZATION FOR DIFFERENTIATION OF INFORMATION

Field of the invention

The present invention relates to polarisation to distinguish QoS classes, and to distinguish payload and header in packets within communicational networks. More generally the present invention relates to a new and improved use of states of polarisation within all types of communicational networks.

Background of the invention

With the introduction and the development of optical networks it is a goal to reduce the cost and complecity of data transmission within Tele and data networks. A major factor for achieving this is to reduce the number of signal transformations between optical and electrical signals. Such a reduction will reduce the number of components within the networks elements and reduce the need for electronic signal processing. Further a reduction in the number of components within the networks element will result in a reduction of the sources of errors, and hence reduced need for service and maintenance and an increased operational time. These factors will again result in a potentially reduced cost.

The traffic volume of Internet is reported to show a significant increase despite the downturn of the telecommunication industry. Hence, increasing parts of the traffic in the transport network origins from packet data. For obvious economic reasons, new switching techniques should first be introduced at the time they show maturity and cost effectiveness. Hence there is a need to develop flexible optical networks supporting a seamless migration from an optical circuit switched (OCS) to an optical packet switched (OPS) backbone network.

Thus by replacing electronical network element with optical network elements it is necessary that the optical network elements have a functionality which can operate effectively within a packet switched network. In the last few years intensive research have been spent on optical packet switching (OPS), and optical burst switching where packets or bursts of packets are switched directly in the optical layer with optical switches. These techniques are expected to be commercially of interest within approximately four years.

The five dimensions

As optical signal processing is still immature there are very restricted possibilities for signalling different types of information such as address information. Dimensions available for transfer of information in an optical fibre are: intensity, time, frequency, phase and polarization. All these dimensions are through the years suggested used for different purposes.

The formats of modulation used in optical links and networks are today based on NRZ- and RZ-formats where intensity varies between a minimum- and maximum level. The signals are time divisional multiplexed (TDM) with a data rate between 2,5 and 40 Gb/sec. In optical line switched networks the available and useable optical frequency spectrum is used for multiplexing a number of TDM-channels within one fibre, so called Wavelength Division Multiplexing (WDM). The optical frequency is also suggested used as a label with optical networks where the framework from MPLS is used. Phase and frequency are suggested used as a form of modulation as to increase spectral efficiency likely in combination with polarization.

Optical packet switching, address, QoS and signalling.

In connection with optical packet switching transfer of address information in the form of a header or a label is a problem for discussion. Normally, in an electronic router the header will be transferred at the beginning of the packet or the frame, and the address information and payload is thereby time multiplexed. Demultiplexing in the time domain is difficult using optical components. Transfer of address information separated from payload is therefore suggested carried out in different manners such as:

1a) Address and payload are separated by the use of separate optical wavelengths; this gives however a bad utilization of the wavelengths.

1b) Usage of a separate frequency within the optical wavelength, so-called Sub Carrier Modulation (SCM), utilizing the optical wavelength more efficiently than when a separate wavelength is used. However, this solution may lead to a deterioration of the payload signal.

1c) In the EU-sponsored project "STOLAS" it is suggested to use frequency modulation for modulation of packet header separated from the payload; however this method may also give a deterioration of the signal quality within the payload. STOLAS is an ongoing project within EUs 5th general plan "IST". Reference for this theme within the project: Sulur, T.K. et al. "IM/FSK Format for Payload/orthogonal Labelling IP Packets in IP over WDM Networks Supported by GMPLS-based LOBS." ONDM 2003, February 3-5, 2003, Budapest, Hungary.

Several techniques have been proposed for in-band header encoding, like serial header, SubCarrier Modulation (SCM), and Frequency Shift Keying (FSK). However, they require advanced components for separation of header and payload, and reinsertion of new headers. To erase old header, before a

at an absolute minimum, like e.g. for remotely controlled surgery. Guaranteed service (GS), without contention causing packet loss, and a fixed delay, can however be offered if the packets are sent through a network following a path with pre-assigned resources, like in a Static or Dynamic Wavelength Routed Optical Network (S-WRON or D-WRON). D-WRONs increases throughput efficiency, compared to S-WRONs, by dynamically reconfiguring the wavelength paths to adapt to the traffic demands. However, the control plane operates on an ms to s timescale, and cannot be optimized to the bursty traffic patterns of OPS, where packet durations are typically in the μs range. Therefore, not even D-WRONs can achieve the throughput efficiency and granularity of statistical multiplexing.

The packet switch

A packet switch may be partial optical and partial electronic or fully optical.

In EP 07944684 A1 it is described an optical packet switched network with one or several nodes and a transmitter sending polarized packet signals. The packet signals comprising a header- and a payload separated from each other by way of orthogonal polarizing. Further it is known from CA 2352113 an optical method of communication where it is utilized a high speed polarized bit stuffing method. The method describes a way of using polarized bit-stuffing for separation of data packet instead of multiplexing data streams from different modulators. This increases the speed for transferring of data within an optical network. Further from US 20030048506 it is shown a method for solving packet congestion at a node output using polarization multiplexing. Two packets arriving at different inputs are supposed to be switched to the same output hence to avoid packet congestion the packets are sent in different orthogonal polarisation states thus enabling simultaneous sending of the packets.

Brief description of the drawings

The enclosed drawings which are included and which form a part of the specification are illustrating embodiments of the present invention and serves, together with the description, as an explanation for the principles of the invention.

Figure 1 shows packets which belong to different QoS-classes assigned relative orthogonal states of polarization. Thus it becomes possible for the receiver to separate two classes of priority optically by the use of a simple polarization beam splitter,

Figure 2 shows the proposed node design. The resources used in the l-switch and packet switch are shared. The number of inputs needed equals the number of input fibres X the number of link-wavelengths, GS = Guaranteed Service. & = Optical And Gate,

Figure 3 shows experimental setup. PC = Polarisation Controller, i.e. device for adjustment of state of polarisation.

Figure 4 shows, Sensitivity curves for two signals, both for back-to-back (stippled lines) and at the egress node. The characteristic of the transmission for the header-/payload separation is measured using modulation on both transmitters, thus this is the most critical situation, with crosstalk between the two polarisation signals. Modulation of both transmitters at the same time is equal to sending header- and payload simultaneously, or having two packets with different QoS class transmitted at the same time. Using this principle prohibits the use of the node as shown in figure 2 due to the fact that this node depends on simultaneous modulation of only one of the polarising states where the other is used as a control signal. Experimentation with modulation of one transmitter at a time has

Figure 2 illustrates one embodiment of the present invention. Header and payload separation is implemented by sending the header in a SOP labelled '1', and the payload in SOP '2', orthogonal to '1'. Separation is done using a PBS, allowing full transparency with respect to bit rate and signal format for both header and payload.

Additionally, if a very high QoS is needed with a Guaranteed Service (GS) with respect to packet loss and delay, like e.g. remote image guided surgery, the GS packets may be forwarded solely on the basis of their wavelength information using a wavelength router. These packets can be separated from e.g. Best Effort (BE) packets by transmitting BE packets in SOP '2', while GS packets are transmitted in the SOP '1', like in figure 2. GS packets will then pass through a wavelength routed network allowing GS, while BE packets will be interleaved with the GS packets at the output of each node, increasing the utilisation of the links. The GS- packets are delayed equally to the longest BE-packet in every node so that by detecting a GS-packet on the input one can reserve the output and make sure that for the moment no BE-packet is transmitted. In this way packet contentions between BE- and GS-packets are avoided.

Both described embodiments can be combined. GS packets will then be sent in SOP '1', without an orthogonal polarisation header, while BE packets will be sent in the SOP '2' with a simultaneously transmitted header in SOP '1'. When a signal is observed in SOP '1', with a signal simultaneously present in SOP '2', the signal in SOP '1' is recognised as the header of a BE packet. If there is no signal simultaneously present in SOP '2', the signal is recognised as a GS packet. When using this method, detection of the simultaneous presence of signals in the two SOP's enables distinction of GS packets and BE headers. If serial BE header is used, distinction can be implemented sending the signals from the two SOP's into an optical AND gate. The GS packets in SOP '1' are forwarded through the AND gate if SOP '2' is

At the input the signal is split according to the optical signal's polarization. The advantage of this solution is a pure optical entity which may be used to split the traffic which is supposed to be handled as first priority, and which is supposed to be handled as BE-traffic. The solution presumes that the transmitting party is classifying priority traffic and BE traffic by sending these with orthogonal polarization relatively to each other. The solution may in principle be an addition to the electronic switch wherein the electronic switch is maintained as it is today, and handled "Best effort"-traffic, while the optical wavelength router is handling first priority traffic. The design will then differ from and be less optimal than shown in figure 8. There will be no possibilities for the electronic switch to let the optical switch handle the traffic when the latter has available capacity. The utilization of the optical part will therefore become less optimal; however the design becomes considerably simplified.

In figure 8 it is thought that a number of wavelengths reserves to the electronic switch and a number to the optical switch. If the optical switch is an addition, this number of wavelengths may be a fixed number, or it may be controlled centrally. If the two switches are built together from the beginning, the number of wavelengths can easier vary and be dynamic and be handled internally in the switch.

Optical switching of both GS and BE packets with a possibility of electronic buffering.

Another design example is given in figure 9. By always delaying packets with high priority (QoS packet), outputs can be reserved so that the destined output is vacant when the packet occurs at the output of the optical buffer.

In this design BE packets may choose freely among all the wavelengths at the output of the switch. In the first stage

node N2, named N2-λ 4, is dropped at N1, and reused for sending QoS packets from node N1 to node N6 (N1-λ 4).

Scalability

Normally the node degree in a transport network like this will be in the order of say 4-8. Also the total number of nodes in the transport network will be limited. In COST 266 a reference scenario for a pan European network is given. Figure 11 illustrates this network. In the network a total of 37 Nodes is present, and it has a maximum node degree of 5. The question is whether a static configuration of QoS resources will be sufficiently effective in a transport network. Whether this is true will depend on the amount of QoS traffic in the network, and the number of wavelengths in each node. The packet switch design described will be effective only when a high number of wavelengths are available. This is because the design relies on using the wavelength dimension for contention resolution. Number of wavelengths should therefore be 32 or more

Dynamic wavelength allocation for scalability

If a dynamic wavelength allocation scheme is employed, wavelengths can dynamically be set up and taken down on demand. This will increase the utilization of the resources available for transmitting QoS packets, since it will allow dynamic changes in the traffic load. If the node in figure 9. is slightly modified, replacing the fixed wavelength converters at the output with tuneable wavelength converters, the wavelength for a QoS path can be allowed to change along the way. This will allow a higher reuse factor of the wavelengths in the network. However, a technical problem when multiplexing the unpredictable wavelengths at the output of the tuneable wavelength converters has to be solved. Normally a low loss multiplexer will be wavelength sensitive. Other approaches to switching the wavelength in the node may be evaluated.

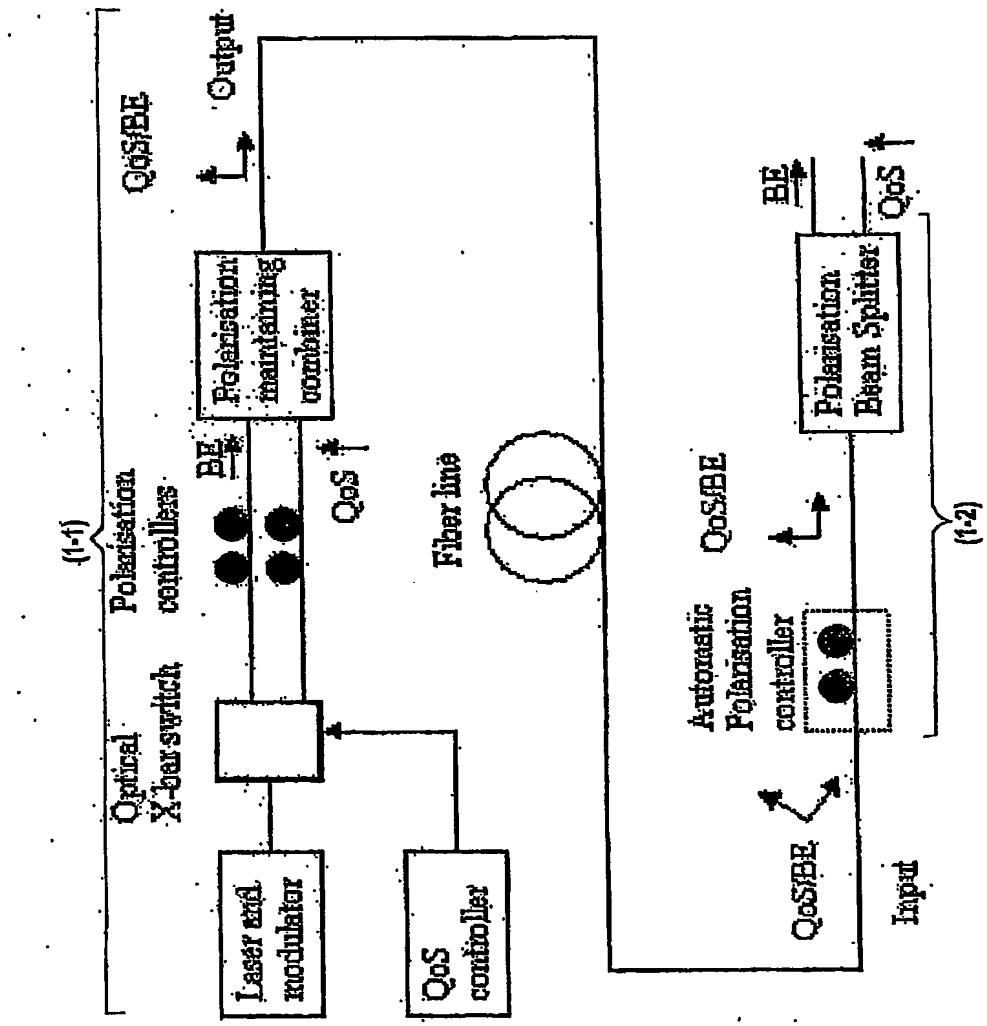

(1-1)
Optical X-bar-switch
Polarisation controllers
Polarisation maintaining combiner
QoS/BE
Output
BE
QoS
Laser and modulator
QoS controller
Fiber line
QoS/BE
Automatic Polarisation controller
Polarisation Beam Splitter
BE
QoS
QoS/BE
Input
(1-2)

Figure 1

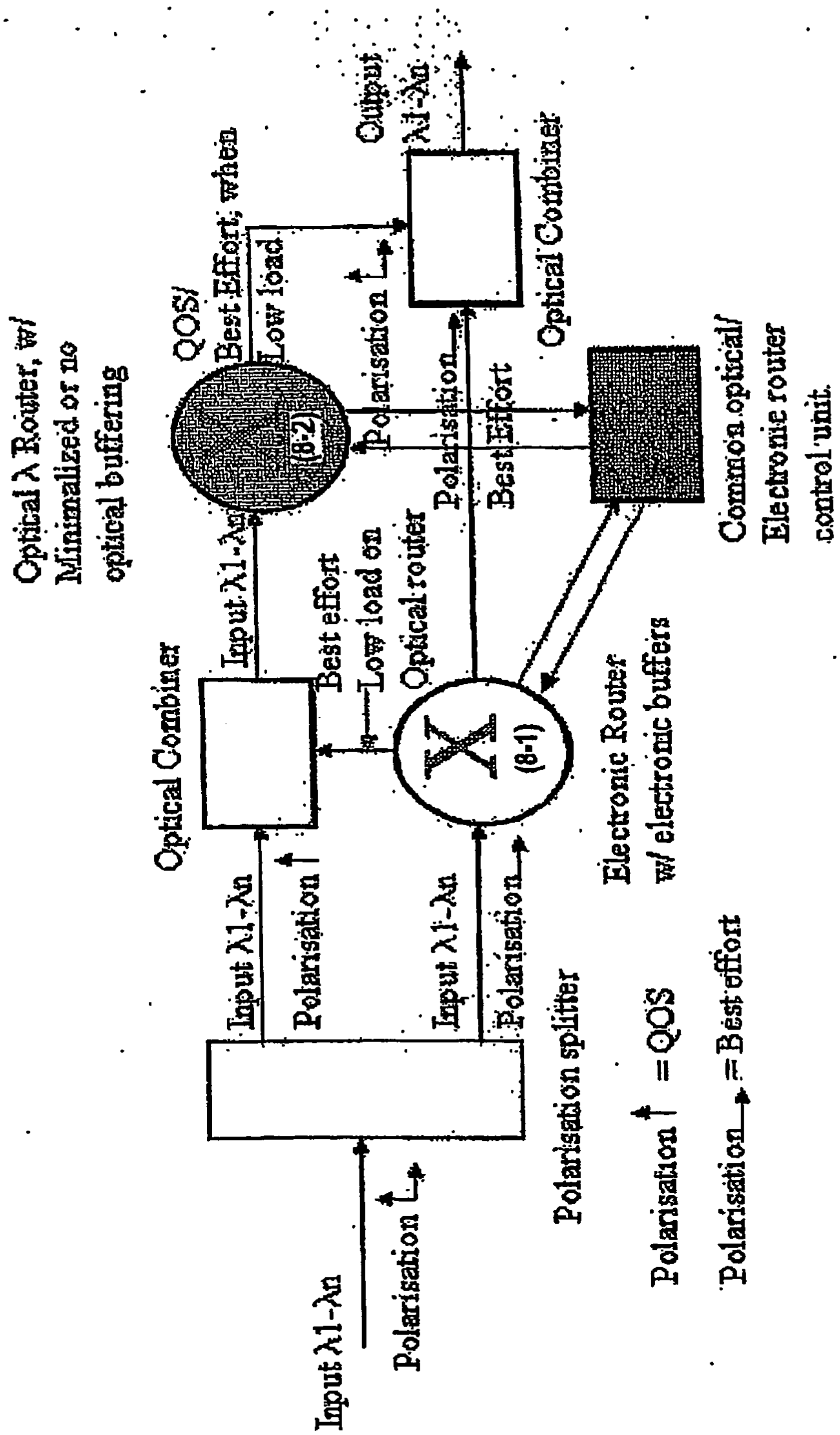
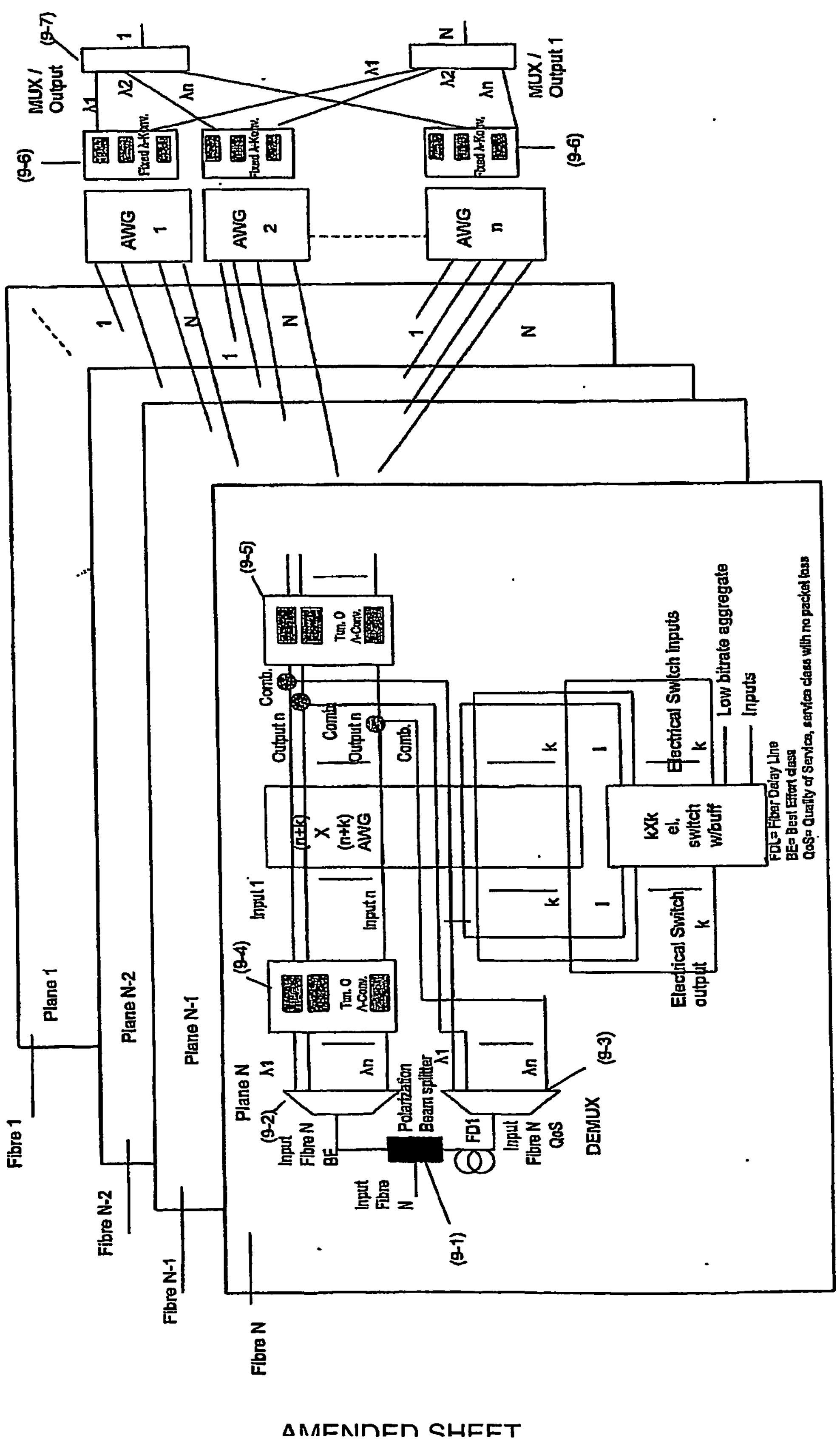

Optical λ Router, w/ Minimalized or no optical buffering
QOS/ Best Effort; when Low load
Output λ1-λn
Optical Combiner
Input λ1-λn
(8-2)
Polarisation
Polarisation
Best Effort
Common optical/ Electronic router control unit
Optical Combiner
Best effort Low load on Optical router
X
(8-1)
Electronic Router w/ electronic buffers
Input λ1-λn
Polarisation
Input λ1-λn
Polarisation
Polarisation splitter
Input λ1-λn
Polarisation
Polarisation = QOS
Polarisation = Best effort

Figure 8



MUX / Output
(9-7)
MUX / Output 1
λ1
λ2
λn
(9-6)
Fixed λ-Konv.
AWG 1
AWG 2
AWG n
1
N
Plane 1
Plane N-2
Plane N-1
Plane N
Fibre 1
Fibre N-2
Fibre N-1
Fibre N
(9-5)
Tun. 0 λ-Conv.
(9-4)
Output n
Comb.
Input 1
Input n
(n+k) X (n+k) AWG
k
l
Electrical Switch Inputs
Low bitrate aggregate Inputs
kXk el. switch w/buff
Electrical Switch output
FDL= Fiber Delay Line
BE= Best Effort class
QoS= Quality of Service, service class with no packet loss
(9-2)
Input Fibre N BE
Polarization Beam splitter
FD1
Input Fibre N QoS
(9-3)
DEMUX
Input Fibre N
(9-1)

Figure 9

Optical packet switching (OPS) is promoted as a way to overcome the electronic bandwidth bottleneck. However, if OPS nodes are to be realised, they must also prove to be cost effective. The present invention proposes to use polarisation multiplexing for a low-cost separation and reinsertion of control information in OPS, as well as for optical differentiation between Quality of Service (QoS) classes. The two applications can be performed simultaneously or separately.

In the present invention it is proposed to combine the properties of a statistically multiplexed packet switched network (OPS) with the GS enabled by optical circuit switched networks (like S-WRON/D-WRON) in a single optical network layer. This requires that the circuit switched GS packets and the OPS packets efficiently share the data layer resources. A node design that allows full sharing of link bandwidth is proposed, and that allows a migration from an S-WRON to the more efficient combined network, by adding OPS capability. The efficiency of the node is studied using a simulator.

The technique proposed here, as presented in the present invention, overcomes the drawbacks as described above by using orthogonal States of Polarisation (SOP) for separating packets and sending control information. By using a Polarisation Beam Splitter (PBS) per wavelength for header/payload separation, the complexity and cost may be reduced significantly, compared to the solutions mentioned above.

Brief discussion of the invention

The present invention discloses a system and a method in accordance with the independent claims enclosed.

less problems with contention between BE packets and less load on the available buffer resources.

Conclusions

An OPS node design according to the present invention supporting GS without packet loss and with fixed delay, as well as a BE service class is proposed. The design supports a migration strategy from circuit to packet switching by starting with an S-WRON module and adding an OPS module. High capacity utilisation is obtained by interleaving statistically multiplexed BE packets with GS packets that follow a pre-assigned wavelength path. The penalty of introducing GS packets in the system is shown to be very moderate if the GS packets is much longer than the BE packets. Aggregation of GS packets into bursts must therefore be considered.

Hybrid electronic/optical switch with QoS

In the following section a hybrid construction is described where a switch is built with an optical forwarding of a class of quality (GS) and an electronic forwarding of another class of quality (BE). Figure 8 presents a sketch of the building.

The switch has two switching matrixes, one electronic and one optical switch matrix. The electronic switching matrix is to a great extent similar to today's electronic switches switching matrix, as known from the Prior Art, and works together with the control entity in a manner known from Prior Art "Best Effort" switches.

The optical switching matrix is supposed to function as a "wavelength router". An inward wavelength is sent to an appointed fibre and outward wavelength. The outward wavelength and the outward fibre are fixed according to the in-ward wavelength and the inward fibre. As shown in figure 8

P a t e n t c l a i m s
(Amended 14 July 2005)

1. A communication network arrangement for handling packets within optical or combined optical/electrical packet switched networks comprising at least a ingress node (fig1;1-1) adapted to multiplex optical packets by polarization and a egress node (fig1;1-2) adapted to demultiplex received optical packets by polarization, c h a r a c t e r i z e d i n that the ingress node (fig1;1-1) is further adapted to:
transmit packets of a first QoS class in a first state of polarization, and transmit packets of a second QoS in a second state of polarization.

2. A communication network arrangement according to claim 1,
c h a r a c t e r i z e d i n that the ingress node is further adapted to:
while transmitting said packets of said second QoS in said second state of polarization, simultaneously transmitting a header in said first state of polarization.

3. A communication network arrangement according to claim 1 or 2,
c h a r a c t e r i z e d i n that said first and said second states of polarization are interchanged at the beginning of each package.

4. A communication network arrangement according to any of the preceding claims,
c h a r a c t e r i z e d i n that the second and first state of polarization are substantially orthogonal states.

5. A communication network arrangement according to any of the claims 1, 2, or 4
c h a r a c t e r i z e d i n that the network

arrangement further comprises at least one core node (fig3) adapted to;

SOP align received packet,

demultiplex the received packets by polarisation, and

multiplex packets for forwarding by means of polarisation.

6. A communication network arrangement according to claim 1, 2 or 4,
c h a r a c t e r i z e d i n that the network arrangement further comprises at least one core node (fig. 3) adapted to demultiplex the received packets by polarisation and to separate packets according to the packets state of polarisation and the core node (fig. 3) further comprises a first optical switching matrix and a second electronic switching matrix.

7. A communication network arrangement according to claim 6,
c h a r a c t e r i z e d i n that the first optical switching matrix is a wavelength router adapted to separate payload of packets of a first QoS class, payload of a second QoS class and header information of the second QoS.

8. A communication network arrangement according to claim 1, 2 or 4,
c h a r a c t e r i z e d i n that the network arrangement further comprises at least one core node (fig.3), said core node (fig.3) comprises at least one polarisation beam splitter (PBS1) and at least one optical demultiplexer.

9. A communication network arrangement according to claim 1, 2 or 4,
c h a r a c t e r i z e d i n that the network

arrangement further comprises at least one core node (fig.3), said core node (fig.3) comprises

two optical demultiplexers,

at least one first wavelength converter

a second wavelength router, and

at least one third fixed wavelength converter adapted to forward packets of the first and second QoS class to a first optical multiplexer.

10. A communication network arrangement according to any of the preceding claims, c h a r a c t e r i z e d i n that the first QoS class represents GS-packets and the second QoS class represents BE-packets.

11. A communication network arrangement according to any of the claims 1, 2 or 9, c h a r a c t e r i z e d i n that the ingress node (fig.2) further is adapted to:

separate header and payload for BE-packets by means of state of polarisation, and

separate packets by changing state of polarisation at the beginning of every new packet,

by means of at least one polarisation beam splitter (PBS) adapted to receive a WDM-signal with a plurality of wavelengths where the polarisation beam splitter (PBS) is adapted to separate header and payload by using the polarization beam splitter per wavelength.

12. A communication network arrangement according to any of the preceding claims, c h a r a c t e r i z e d i n that the system is

adapted for use with at least two states of polarisation for signalling traffic.

13. A communication network arrangement according to any of the claims 5-12, c h a r a c t e r i z e d i n that the ingress node and/or the at least one core node comprises an optical packet switched module attached to a S-WRON node.

14. A communication network arrangement according to any of the claims 1-7, 9, 11,or 12, c h a r a c t e r i z e d i n that the network arrangement is adapted to use the derivative of said state of polarisation for separating one or more QoS.

15. A communication network arrangement according to claim 6, c h a r a c t e r i z e d i n that the at least one core node (fig.8) is adapted to switch packets electronically or optically according to which QoS class the packets are associated with.

16. A communication network arrangement according to claim 15, c h a r a c t e r i z e d i n that a number of wavelengths is reserved for the at least one core node of the network adapted to switch packets electronically.

17. A communication network arrangement according to claim 15, c h a r a c t e r i z e d i n that a number of wavelengths is reserved for the at least one core node of the network adapted to switch packets optically.

18. A method for handling packets within optical or combined optical/electrical packet switched networks comprising at least a ingress node (fig.1;1-1) for multiplexing of optical packets by polarization and a

egress node (fig.1;1-2) for demultiplexing of received optical packets by polarization,
c h a r a c t e r i z e d i n the step of:
transmitting packets of a first QoS class in a first state of polarization and transmitting packets of a second QoS in a second state of polarization.

19. A method according to claim 18,
c h a r a c t e r i z e d i n transmitting said packets of said second QoS in said second state of polarization simultaneously transmitting a header associated with the second QoS in said first state of polarization.

20. A method according to claim 18 or 19,
c h a r a c t e r i z e d i n that interchanging said first and said second states of polarization at the beginning of each package.

21. A method according to claim 18-20,
c h a r a c t e r i z e d i n that the second and first state of polarization are substantially orthogonal states.

22. A method according to claim 18, 19 or 21,
c h a r a c t e r i z e d i n that the network further comprises at least one core node (fig.3), said core node (fig.3) executes at least one of the following steps:

a) demultiplexing received traffic by polarisation, and/or

b) polarizing the received traffic, and/or

c) SOP-aligning received traffic.

23. A method according to claim 18, 19 or 21,
c h a r a c t e r i z e d i n that packets are separated into a first and a second class of quality, where packets of the first class is routed using a predefined

route within a communication network, and packets of the second class is switched by a packet switch module.

24. Method according to claim 18 or 20, c h a r a c t e r i z e d i n that at the ingress node packets are separated into two classes by setting switches based on header information from said packets.

25. A method according to claim 20, c h a r a c t e r i z e d i n that at the at least one core node in the optical packet switched network is executing time divisional multiplexing of received packets.

26. A method according to claim 22-25, c h a r a c t e r i z e d i n that at least one core node (fig.3) in the optical packet switched network is SOP-aligning (fig.3;PC) received packets.

27. A method according to claim 22, c h a r a c t e r i z e d i n that when a first packet of a first QoS class of the type GS-packet arrives at a switch the following steps are carried out:

a controlling device registering that the first packet is present at the input,

then delaying the first packet in a FDL in a first pre-determined period of time, and

reserving an output where the first packet is directed to be transmitted.

28. A method according to claim 27, c h a r a c t e r i z e d i n defining the first predefined period of time to be longer than a second period of time, defining the second period of time using a packet with a lower QoS level than the first packet where the second packet is of a maximum allowed size.

29. A method according to claim 21, c h a r a c t e r i z e d i n that statistically multiplexed packets of the second QoS class is interleaved with packets of the first QoS class, and the packets of the first QoS class uses a predefined wavelength path within a communication network.

30. A method according to any of the claims 18-29, c h a r a c t e r i z e d i n assigning the first QoS class to GS-packets and assigning the second QoS class to BE-packets.

31. A method according to claim 30, c h a r a c t e r i z e d i n forwarding GS-packets optically using an optical switch and forwarding BE-packets electronically using an electronic switch (fig.8).